BOTANICAL MUSEUM LEAFLETS
DECEMBER, 1977

VOL. 25, NO. 10

BRUNFELSIA IN ETHNOMEDICINE*

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The genus *Brunfelsia* belongs to the alkaloid-rich family Solanaceae and usually is placed in the relatively advanced tribe Salpiglossideae. *Brunfelsia* is a medium-sized genus of about 42 species of small trees and shrubs: 22 species are confined to the West Indies; 20 species are found in tropical South America.

Various species from South America have long been recognized by native peoples for their medicinal properties. Some of these plants are cultivated for use as household remedies with specific therapeutic effects. These effects have apparently been discovered independently by unrelated peoples in widely separated parts of the continent. Yet chemically and pharmacologically, species of *Brunfelsia* are still virtually unknown — a disturbing fact considering the many important drug plants in the Solanaceae which are commonly used in pharmacy today.

At least five species of *Brunfelsia* are known to be of some medicinal importance. Other species of the genus are suspected of having pharmacological activity or of possessing alkaloids or other active constituents. My purpose in this account is to review the literature on these plants and to present pertinent ethnobotanical data collected during my own field work and that of other workers, in order to rekindle the interest of chemists and medical researchers in this pharmacologically rich genus.

1. **Brunfelsia uniflora** (Pohl) D. Don

The most important medicinal species of *Brunfelsia* is *B. uniflora*, the well known *manacá* root of the Brazilian phar-

* Based in part upon "The South American Species of *Brunfelsia* (Solanaceae)", a doctoral dissertation presented at Harvard University, December, 1973.

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macopeia. This plant is often referred to, albeit incorrectly, by a later synonym, *B. Hopeana* (Hook.) Benth., particularly in horticultural and pharmaceutical literature. It has also been confused with two closely related species: *B. australis* Benth. and *B. pilosa* Plowman (Plowman, 1974).

Brunfelsia uniflora is one of the most widely distributed species of the genus. It occurs throughout southeastern Brazil south to São Paulo, extending northward along the coast nearly to Belém do Pará. Disjunct populations are found in the eastern Andes of southern Bolivia and northwestern Argentina, and in northern Venezuela.

In its native Brazil, this plant was aboriginally known by a number of Tupí names. The most frequent is *manacá* (or its variant *manacán*), a word attributed to the most beautiful girl of the tribe and transferred to the most beautiful flower of the forest (von Marius, 1843). Throughout Brazil, the name *manacá* may be used for any species of *Brunfelsia*. However, in the pharmaceutical trade, the term "*manacá* root" always refers to *B. uniflora* and will be used in this strict sense in this paper.

Other vernacular names of *Brunfelsia uniflora* are related to its use in folk medicine. *Cangambá* and variants *camgâba, cambambá, camganiba* and *caá-gambá* mean the "tree of the gambá". *Gambá* is a species of opossum *(Didelphis cancrivora)*, known as *mucurá* in Portuguese the odor of which the roots of *B. uniflora* are said to emit (Peckolt, 1909; Tastevin, 1922). *Jeratacaca* and variant *jeratacá* loosely translate "snake bite remedy", taken from the native name of the snake *Mephitis suffocans* (Tastevin, 1922). *Umbura-puama* is another name for *manacá* which means "medicine tree" (Peckolt, 1909).

In addition to the indigenous Tupí names, *manacá* also bears several Portuguese common names: *mercurio vegetal* (vegetable mercury, referring to its antisyphilitic properties), *mercurio dos pobres* (poor man's mercury), *flor da Quaresma* (Easter flower), *flor de Natal, Santa Maria* and *boas noites* (Peckolt, 1909).

When the first Portuguese explorers arrived in Brazil, they found *Brunfelsia uniflora* in use by aboriginal Tupí *payés* or medicine men, employed both for healing and magical proper-

ties. An extract of the root was a constituent in arrow poisons (Peckolt, 1909).

The first reference to *manacá* root appeared in the literature in 1648 in *De Medicina Brasiliensi*, an early materia medica written by Willem Piso. Piso was a Dutch physician who traveled in northeastern Brazil from 1637 to 1644 with the German physician Georg Marcgraf. Piso's work provided a description of *manacá* root and its uses, as well as a line drawing, the first illustration of the genus *Brunfelsia*. He states that the scraped bark is a strong purgative, resembling scammony (*Convolvulus scammoniae* L.). Piso's remarks and illustration were repeated by Marcgraf in his *Historia Rerum Naturalium Brasiliae*, published posthumously and bound together with the work of Piso.

Manacá was first named scientifically *Franciscea uniflora* by Pohl in 1827. The correct combination *Brunfelsia uniflora* was made in 1829 by David Don, who recognized the similarity of *Franciscea* to the earlier genus *Brunfelsia*. In 1843, von Martius, an outstanding student of Brazilian medical botany, discussed at length the medicinal uses and pharmacological effects of *manacá* root. His observations were very thorough for the time and often copied by later authors. The substance of his account of *manacá* follows:

> "The whole plant, most of all the large root, stimulates the lymphatic system with great efficacy. It melts away the disease-producing parts and eliminates sweat and urine. It is very useful in syphilis and is called 'vegetable mercury' by some. The inner bark and all the herbaceous parts have a nauseating bitterness and are effective for *fauces vellicantes*. A small dose relaxes the body. A larger dose moves the bowels and the urine, produces abortion and expels the venom of snakebites. An excessive dose acts like a bitter poison . . . . Among some tribes of Indians in the Amazon region, an extract of *manacá* is used in arrow poisons."

Further observations on the effects of *manacá* root appeared in 1871 in a work on toxic plants of Brazil by J.M. Caminhoá. Quoting several obscure authors, Caminhoá reported the following effects not mentioned by von Martius: abundant salivation, vertigo, general anesthesia, partial paralysis of the face, swollen tongue and turbid vision. He also mentions the great usefulness of the drug in treating rheumatism.

Baêna, cited by Caminhoá, claimed that *manacá* was used by the Indians to produce "furious delirium and persistent insanity" as well as "confusion of ideas, inconstant delirium and tremor". This is one of the few accounts reporting the use of *manacá* for narcotic or possibly hallucinogenic effects, in this case resembling belladonna intoxication. Another such account is found in a glossary of Tupí names of plants and animals (Tastevin, 1922):

> "One kind of *manacá* has the property of causing intoxication, blindness, and the retention of urine during the day; but after having drunk the infusion of the root or bark of this tree, a man is always happy in his hunting and fishing."

Unfortunately we do not know the specific identity of this kind of *manacá*.

The roots of *manacá* used either fresh or dried and are considered to be the most effective part of the plant. All parts, however, are used medicinally in Brazil. The root is most often powdered or prepared as a fluid extract, of which a usual dose is 10 -30 minims (0.6 -1.8 cc.) three times daily. It is a powerful and energetic healing agent which has been used for many disorders. In recent times, its most general application has been against syphilis and rheumatism, and for its diuretic and diaphoretic properties. The known pharmacological effects and medicinal uses of *manacá* root are summarized as follows:

Summary of Pharmacological Effects of Manacá Root (*Brunfelsia uniflora*)

1. Diuretic (von Martius, 1843; Peckolt, 1909; Wren, 1956)
2. Diaphoretic (von Martius, 1843; Brandt, 1895)
3. Purgative (Piso, 1648; von Martius, 1843; Dragendorff, 1898; de Almeida Costa, 1935)
4. Emetic (Dragendorff, 1898; Peckolt, 1909).
5. Alterative (von Martius, 1843; Peckolt, 1909; Wren, 1956)
6. Anesthetic (Caminhoá, 1871)
7. Abortifacient (von Martius, 1843; Brandl, 1895, de Almeida Costa, 1935).
8. Emmenagogue (Peckolt, 1909; Le Cointe, 1947)
9. Antirheumatic (Caminhoá, 1871; Dragendorff, 1898; Webb, 1948; Wren, 1956)
10. Antisyphilitic (von Martius, 1843; Kunkel, 1901; Peckolt, 1909; Webb, 1948)

11. Antiscrophular (Dragendorff, 1898)
12. Poisonous (von Martius, 1843; Brandl, 1895; Le Cointe, 1947; Webb, 1948)
13. Anti-inflammatory (Iyer et al., 1977)
14. Narcotic (Caminhoá, 1871)
15. Stimulates endocrine system (von Martius, 1843; Caminhoá, 1871; Brandl, 1895)
16. Stimulates lymphatic system (von Martius, 1843)
17. Lowers body temperature (Brandl, 1895)
18. Increases blood pressure and respiration (de Almeida Costa, 1935)
19. Produces parasthesia (Peckolt, 1909)
20. Produces muscular tremors and cramps (Brandl, 1895; de Almeida Costa, 1935)
21. Produces delirium, vertigo and clouded vision (Caminhoá, 1871)
22. Activates peristalsis (Brandl, 1895)

The leaves of *Brunfelsia uniflora* are also employed medicinally but only in the fresh state (Peckolt, 1909). They are considered to be less active pharmacologically than the roots. The leaves are most commonly used as an antidote for snakebite. A tincture is prepared and given in frequent doses to the victim, and a poultice of the leaves is placed directly on the wound to "draw out the poison". Poultices are also employed for skin disorders such as eczema and syphilitic ulcers. The bark and young shoots of *manacá* are considered resolvent and, in high doses, emetic (Pereira, 1929). By means of ether, a perfume is extracted from the fragrant flowers (Corrêa, 1909).

The first systematic investigations of *manacá* root began about 1880, when the drug stirred some interest among chemists and pharmacologists in Germany and in the United States. In 1880, J. L. Erwin attempted to determine the general classes of constituents in the root. He failed, however, to find any compound which could account for its potent effects. Brewer, in 1882, performed the first pharmacological studies with *manacá* by observing the effects of the fluid extract on cats and frogs and on himself. He concluded that *manacá* acts chiefly on the spinal chord by first stimulating, then abolishing the activity of the motor centers, with similar action in the respiratory center. All the glands were markedly stimulated, including salivary, gastric, intestinal, cutaneous, and the liver and kidneys. He found no effects on the brain or sense organs.

Brewer's self-experiment with *manacá* root furnishes us with a rare, firsthand account of the effects on humans. Taking

the fluid extract on a full stomach, he experienced a feeling a restlessness followed by lassitude, a profuse sweating and an increase in amounts of saliva and urine.

In 1884, Lenardson, a student of Dragendorff working in Dorpat (now Tartu in Estonia), discovered an alkaloid in *manacá* root, the first to be isolated from the root. He named the compound *manacine*, which he characterized as an amorphous, hygroscopic yellow powder with the empirical forumula
$C_{15}H_{23}N_4O_5$ and a melting point of 115°. Manacine was soluble in water and alcohol but insoluble in benzene, ether and chloroform. It produced non-crystalline precipitates with several alkaloid precipitation agents. In addition to manacine, Lenardson found a fluorescent substance which he thought to be gelseminic acid.

A second alkaloid *franciscein* was reported from *manacá* root in 1887 by Lascelles-Scott, but this was never substantiated by isolation and identification of the compound.

The most complete study on *manacá* root during this period was conducted by Brandl in Germany (Brandl, 1895; Beckurts, 1895). He summarized Lenardson's dissertation and presented the results of his own detailed chemical and pharmacological investigations.

Brandl confirmed Lenardson's discovery of manacine but claimed a different empirical formula $C_{22}H_{33}N_2O_{10}$ and melting point of 125°. From the residue remaining after the alcoholic extraction of manacine, Brandl found an additional substance which he named *manaceine*. He characterized this constituent as an amorphous, white, highly refractive compound, soluble in water but insoluble in ether, chloroform and benzene. Brandl gave the empirical formula $C_{15}H_{25}N_2O_9$ for manaceine. When heated with water, manacine splits into manaceine and a resinous, fluorescent substance which he considered to be the aglycone esculetin (6, 7-dihydroxycoumarin). Although Brandl managed to isolate two alkaloids from the root, he never obtained a crystalline compound, nor was he able to characterize their structures.

Schultes (1966) suggested that manacine is an "atropine-like" alkaloid. There is in fact no basis for this statement.

Manacine actually shows the opposite effects of atropine which inhibits rather than stimulates glandular secretions. At the present, the structural identity of manacine remains unknown.

Brandl, following the work of Brewer, conducted pharmacological experiments on frogs, rabbits and guinea pigs, using the manacine and manaceine of his extractions. He found manacine to have an intense action, even in small doses. In mammals, it induced strong muscular tremors and epileptiform cramps, lowered temperature, followed by death due to respiratory paralysis. All the glands were strongly stimulated, as Brewer had observed earlier. Peristalsis was also increased. Glandular stimulation, but not peristalsis, was blocked by atropine. Frogs showed a general paralysis after an initial period of unrest, followed finally by heart arrest in diastole. With manaceine he observed a similar but less intense action.

Peckolt (1909) repeated some of Brandl's work on *manacá*. He found two products in the root, manacine and another alkaloid which he named *brunfelsine*, but he offered no further characterization of either compound. He stated that the seeds of another species, *Brunfelsia brasiliensis* (Spreng.) Smith & Downs [reported as *B. ramosissima* (Pohl) Benth.], contain 1.14% brunfelsine but no manacine. Hoppe (1958) stated that the leaves and seeds of this species contain both manacine and brunfelsine. In its native Brazil, *B. brasiliensis* is considered poisonous according to data from herbarium specimens *(V. Assis 142)*.

Pammel (1911) listed two alkaloids for *manacá* root, manacine and mandragorine. "Mandragorine" is a name given to an alkaloid isolated in 1889 from *Mandragora officinarum* L. This was later shown to be a mixture of l-hyoscyamine, l-hyoscine (l-scopolamine) and a new alkaloid known as mandragorine. This compound bears the empirical forumla $C_{15}H_{19}O_2N$ and forms a crystalline aurichloride with a melting point of 124-126°. On hydrolysis, it yields tropic acid and a base resembling tropine (Henry, 1949; Manske & Holmes, 1950). There have, however, been no subsequent reports of tropane alkaloids in *Brunfelsia* species.

More recently, the identity of the crystalline, blue-fluores-

cent substance in *manacá* root has been identified (Mors & Ribeiro 1957). It had earlier been determined as gelseminic acid by Lenardson (1884) and as esculetin by Brandl (1895). This constituent is now known to be the aglycone scopoletin (6-methoxy-7-hydroxycoumarin) of the lactone glycoside scopolin. It is found in all parts of the plant and in several other species as well: *Brunfelsia pauciflora* (C. & S.) Benth. (reported as *B. calycina* var. *macrantha* (Lem.) Bailey & Raffill), *B. brasiliensis* (reported as *B. ramosissima*) and *B. grandiflora* D. Don. Machado de Campos (1964) found much smaller amounts of scopoletin in the seeds of *B. uniflora* and *B. grandiflora*. This compound occurs in several other genera of Solanaceae including *Atropa*, *Solanum* and *Lycopersicon*. It may function as a regulator of growth processes in plants but is not known to be pharmacologically active in humans.

With the exception of anatomical and pharmacognostic studies on *manacá* root (Hahmann, 1920; de Almeida Costa, 1935), only one recent paper has appeared on the nature and action of the drug. Iyer *et al.* (1977) conducted hippocratic screening in rats of whole root and extracts of *Brunfelsia uniflora* (reported as *B. Hopeana*). Administered intraperitonially, the whole root showed the following dose-related symptoms: decrease in spontaneous motor activitiy, irregular respiration, paralysis of hind and forelegs, analgesia, mixed convulsions, hypersensitivity to sound, increase in pupil size and slight diuresis. These symptoms, indicating CNS depressant activity, were concentrated in a chloroform extract ("F"), the lethal dose of which was about half that of the whole root. The authors also showed that this fraction has marked anti-inflammatory activity when compared with phenylbutazone in reducing carrageenin-induced pedal edema in rats. These workers are currently undertaking a detailed investigation of the components of the chloroform extract.

Currently, *manacá* root is fully recognized in the Brazilian pharmacopeia and is considered a valuable remedy in that country where folk medicine is still very important in rural areas. Like many poorly known drugs of plant origin, *manacá* has been generally discredited in the United States for "lack of convincing evidence of its usefulness" (Osol and Farrar, 1955).

This constitutes an unjust appraisal of a potent drug with a possible future in treating rheumatism and arthritis.

2. **Brunfelsia Mire** Monachino

In 1921, H.H. Rusby of Columbia University took part in the Mulford Biological Expedition to the Amazon. During this trip he collected a plant called *miré* in the Yungas region of Bolivia. The plant was sterile at the time of collection but Rusby noted its resemblance to *manacá (Brunfelsia uniflora)*. He reported that the Indians of the region employed *miré* to expel cutaneous parasites and to "paralyze the voluntary muscles as in an alcoholic intoxication". They boiled the plant to extract the drug, a process which apparently does not injure the active constituents. *Miré* produced a profuse sweating capable of destroying all cutaneous parasites but with no disturbance of the senses or intellect (Rusby, 1924).

Concurrently with Rusby's initial report, T. S. Githens published his pharmacological studies on the effects of *miré*. He confirmed the drug's paralyzing effect on the voluntary muscles through an action on the spinal chord. He also observed stimulation of the peripheral motor-apparatus indicated by muscular twitching. Both the sweat and salivary glands were stimulated in rabbits and frogs (Githens, 1924).

Two years later, Githens (1926) published an article on the chemistry of *miré*. In analyzing extracts of the root and stem, he isolated three principles:

1. A strongly fluorescent body soluble in alcohol, ether and chloroform but insoluble in water. In mice, this portion caused paralysis, but without twitching of the muscles.
2. An alkaloid soluble in alcohol but precipitated from alcoholic solution by ether. He found 0.3% crude alkaloid which was pale yellow in freshly prepared solutions but soon became a reddish wine color on standing. This fraction was very active physiologically.
3. A second alkaloid was present which was soluble in alcohol but not precipitated by the addition of ether. This body corresponded to 0.5% of the root and gave a permanently pale

yellow solution. Its action resembled that of the first alkaloidal portion.

Miré was identified in 1925 as *Brunfelsia hydrangeiformis* (Pohl) Benth. by Youngken, who carried out a detailed pharmacognostic study of *miré*. *Miré* is now known to constitute a distinct species, *B. Mire*, described by Monachino in 1957. The plant is found in parts of Amazonian Peru and Brazil and is a close relative of *B. hydrangeiformis* which is restricted to southeastern Brazil.

The findings of Rusby and Githens on *miré* recall the earlier studies on *manacá* root, especially the occurrence of two similar alkaloidal fractions and a strongly fluorescent substance. In addition, the stimulation of the sweat and salivary glands are likewise known in *manacá*, suggesting that similar types of compounds may occur in unrelated species of the genus.

One herbarium collection of *miré (Cárdenas 2813)* bears the interesting comment that cattle die when they eat the leaves, a further indication of its toxic activity. Two other species, *B. brasiliensis* and *B. grandiflora*, are also reported to be poisonous to cattle. *B. Mire* remains relatively unknown from chemical and pharmacological standpoints and clearly merits additional phytochemical work.

3. **Brunfelsia grandiflora** D. Don

Brunfelsia grandiflora is widely recognized in the upper Amazon for its potent drug effects. Yet its identity and uses have long been obscured in the literature by misidentifications and confused ethnobotanical reports. Specimens of *B. grandiflora* in herbaria are consistently and erroneously determined as *B. latifolia* (Pohl) Benth., *B. maritima* Benth. or *B. bonodora* (Vell.) Macbr. There have been numerous notes on herbarium labels that this species is medicinal, narcotic and/or poisonous, but reports in the literature are sparse and misleading.

Beginning in 1967 and in later publications, Schultes brought to the fore the question of the possible use of *Brunfelsia* as a hallucinogen, referring specifically to its widespread cultiva-

tion in the Colombian Putumayo (Schultes 1967, 1969, 1970a, 1970b, 1970c; Schultes & Hofmann, 1973). He suggested that this species (reported originally as *B. maritima*) may have been employed more extensively in the past and that, as native peoples have become acculturated, its use has died out.

Brunfelsia grandiflora is distributed throughout western South America from Venezuela south to Bolivia and east to the Brazilian Amazon. It is also extensively cultivated in the American tropics as an ornamental. However, only in western South America are its curious medicinal properties recognized by native healers. *B. grandiflora* has one subspecies — subsp. *Schultesii* Plowman — recognized chiefly by its much smaller flowers and fruits. Both forms, however, seem to be used interchangeably in folk medicine. Subsp. *Schultesii* is more widespread in the lowlands and the form more likely to be employed.

Many different Indian tribes in the Amazon region are acquainted with this species, and it is known by many vernacular names. The most widely used names are *chiricaspi* and *chiric sanango*, both Quechua words, found in southern Colombia and Amazonian Peru respectively. *Chiricaspi* means "cold tree"; *chiric sanango* signifies "cold medicine". Both names incorporate the Quechua word *chiric* which means "cold", in reference to the sensation of chills reputedly produced upon ingestion of the roots or bark. *Chiric guayusa* is another variant found in lowland Ecuador (Pinkley, 1969).

Brunfelsia grandiflora, like other plants which yield potent drugs, has multiple uses: as a medicine, as a narcotic and, in higher doses, as a poison. By no means exclusive of each other, these classes of usage frequently intergrade in everyday reality.

Brunfelsia grandiflora as a Poison

Schultes (1967) mentions that this plant is considered poisonous to cattle near Leticia in the Colombian Amazon. Data from herbarium specimens collected in Bolivia (*Steinbach 1805, 5487*) also indicate that the plant is very poisonous, especially to cattle which occasionally eat the foliage. Another

collector (*Heinrichs 4961*) states that the roots are employed in Ecuador as a fish poison.

Brunfelsia grandiflora as a Medicine

Collectors of the species frequently mention the effect of cold or chills produced when the ground bark or root is taken (*Cuatrecasas 11275*, *Mexia 6444*, *Pinkley 43*, *202*, *444*, *450*, *457*, *Plowman 2019*). Other reports indicate that the roots are employed against rheumatism (*Mexia 6444*, *Plowman 2494*, *Woytkowski 6170*). Still other workers have stated that the plant is used against fevers (*Juajibioy 277*; *Pérez Arbeláez 688*; *Plowman 2040*), against snakebite (*Scolnik 1495*) or simply that it is medicinal (*Woytkowski 5525*).

My field work and that of others in the Amazon basin have served to substantiate these often vague claims of physiological activity. In the region around Iquitos, Peru, and probably throughout most of the Peruvian Amazon, *Brunfelsia grandiflora* is one of the most important medicines against rheumatism and arthritis. One informant, a Kokama Indian from the Río Ucayali, provided the following recipe for preparing the drug (Tina, 1969):

> "The root is scraped and placed in cold water or *chicha de maíz*. This is then taken in wineglassful doses. To increase the dose, the bark of other trees may be added, including *remocaspi* (*Pithecellobium laetum* Benth.), *chuchuhuasi* (*Heisteria pallida* Engl.) and *huacapurana* (*Campsiandra laurifolia* Benth.). The root of *chiric sanango* may also be prepared with *aguardiente* (cane alcohol). About 50 grams of scraped root and bark are added to one liter of alcohol. A small glass is then drunk before meals until four liters have been consumed."

Pinkley, who worked extensively on the ethnobotany of the Kofán tribe of Ecuador and Colombia, found that the lowland Quechuas on the Río Napo in Ecuador also utilize *Brunfelsia grandiflora* as a remedy for rheumatism:

> "They take it if they have a burning in the lower part of their back. They place their hands in the area of the kidneys. Upon

making a drink from the leaves in hot water, they become extremely chilled after drinking." (Quoted in Schultes, 1966).

Pinkley (1969) later added that the Kofáns of the Putumayo also use the plant for high fevers and severe back pains.

The leaves of this plant are also employed in the Iquitos region as a cure for bronchitis (Tina, 1969):

"Twelve fresh leaves of *chiric sanango* are crushed up, then squeezed and the juice mixed with a little water. A spoonful is drunk twice a day, in the morning and at evening during three days."

In contrast to the root and bark, the leaves reputedly do not cause nausea.

The Siona Indians of the Colombian Putumayo similarly employ *Brunfelsia grandiflora* as an analgesic to alleviate pain. They say that it has a strong numbing effect, permitting one to walk long distances, even if the feet ache (Langdon, 1972). In an isolated report, Steward and Métraux (1948) state that the Chama Indians of Peru take the roots of *Brunfelsia grandiflora* as an aphrodisiac. The method of use is not given.

Brunfelsia Grandiflora as a Hallucinogen

This species has long been suspected of possessing narcotic or hallucinogenic properties (Schultes, 1966, 1967; Schultes & Hofmann, 1973). Herbarium labels from Peru (*Tessmann 3243*) and southern Colombia (*Bristol 1364, Pinkley 420*) indicate that the plant is a *borrachera*, a term which translates "intoxicant" and which is applied to the narcotic tree Daturas and other plants. Friedberg (1965) and Pinkley (1969) first disclosed that *Brunfelsia* species serve as admixtures to the hallucinogenic drink *ayahuasca* or *yagé* prepared from *Banisteriopsis Caapi*.

In 1928, the French botanist Benoist published a new species, *Brunfelsia Tastevinii*, which he claimed was used as a hallucinogen in the Brazilian Amazon. Benoist named the plant for its discoverer P. Tastevin, a missionary and anthropologist who reported its use among the Kachinaua tribe of the Rio

Jordão, a tributary of the Rio Tarauacá. I have examined the type specimen of *B. Tastevinii* which is preserved at the Museum of Natural History in Paris. This plant is clearly *B. grandiflora* and Benoist's *B. Tastevinii* must therefore be placed in synonymy with this species.

The Kachinaua were said to cultivate the plant, which they called *keya-honi*, and to prepare a beverage from it. The effects of *keya-honi* were described by Tastevin as follows:

> "The juice of this plant plunges them [the Indians] into a kind of intoxication or stupefaction which lasts a little more than a quarter of an hour and from which they acquire magical powers, enabling them to heal all sorts of diseases through incantations. While the effects of the drink act on their brains, they are unable to fall asleep. They believe they see all kinds of fantastic animals: dragons, tigers, wild boars, which attack them and tear them to bits, etc. This action of *honi* lasts four or five hours depending on the quantity ingested."

This account raises some points of skepticism. The description of the effects of *keya-honi* is strikingly similar to that often given for *Banisteriopsis* intoxications (Rivier & Lindgren, 1972; Naranjo, 1973) and unlike any other reports of *Brunfelsia* intoxication. It is my contention that Tastevin confused these two plants. He himself stated earlier (Tastevin 1926) that the Kachinauas of the Upper Tarauacá knew and esteemed *caapi* (*Banisteriopsis*) for "learning the future, conversing with spirits, or dispelling bad luck". He further stated that the Panoan name for *caapi* is *keya-honi* or simply *honi*, "the liana". It seems possible that he was shown a plant of *Brunfelsia* used as an admixture to *caapi* and took it to be the main ingredient of the hallucinogenic mixture. Studies of hallucinogen use among the Kachinaua in neighboring Peru (Der Marderosian et al. 1970; Kensinger, 1973) demonstrated the use of *Banisteriopsis* and *Psychotria* species to prepare the hallucinogenic drink called *nixi pai*. No mention is made of *Brunfelsia* admixtures, and it is possible that knowledge of the use of this drug is dying out, at least among certain segments of the tribe.

Other reports of the use of *Brunfelsia* as an admixture to *Banisteriopsis* preparations are more substantial. In Iquitos, Peru, *B. grandiflora* is added to *ayahuasca* "to give more

strength." It reputedly makes a sound "like rain in the ears" (Tina, 1969). A Witoto Indian living at Puca Urquillo on the Río Ampiyaco (Peru) informed me that *chiric sanango* is taken to gain strength at the new moon. The bark is scraped and mixed with cold water to prepare the beverage.

The Jívaro of Amazonian Ecuador and Peru are famous for their ritual use of *Banisteriopsis Caapi*, which they call *natemä*, to achieve trance-like states (Harner, 1968). A Canadian businessman, D. C. Webster, reported in a letter to R. E. Schultes the use of three plants in the preparation of the *natemä* drink among the Jívaro, along with photographs of the plants. Besides *natemä* (*Banisteriopsis*), they included chiricaspi (*Brunfelsia grandiflora*) and an unidentified liana called *hiaji*. To prepare the drink, the *natemä* is cut up into small pieces and boiled for at least 14 hours. Then the second two ingredients, also cut up, are added and the mixture boiled down to form a thick, muddy liquid (Webster, 1970).

The supposed effects of this *natemä* mixture, in addition to strong visual hallucinations, include the "melting away of disease" with beneficial effects against arthritis, intestinal parasites, tuberculosis, and poor vision. This is a good example of shamanistic healing methods, in which a strong hallucinogen provides the necessary spiritual contact with the forces of illness, while other potent herbal admixtures give specific therapeutic effects. In this preparation of *natemä*, the antiarthritic effects may be attributable to the addition of *Brunfelsia*.

Brunfelsia is known to play a part in shamanistic practices in still other tribes. Shamans often invoke the aid of a particular spirit helper in their healing ceremonies, which may take the form of a bird, snake, insect or plant. Shamans of the Lama tribe, who inhabit the region just west of Tarapoto in northern Peru, consider *B. grandiflora* a spiritual guide (Steward, 1948). Steward writes in the Handbook of South American Indians:

> "The neophyte sorcerer dieted and took tobacco juice, cigars, *ayahuasca*, and uniquely, *Brunfelsia grandiflora* and another liana. He acquired a general power from these plants but no internal "thorns". To cause illness, he impregnated a splinter with his power and cast it at his victim. To cure it, a shaman sucked out the splinter." (Steward & Mètraux, 1948).

In southern Colombia, particularly the Putumayo region, *Brunfelsia* is also added to *Banisteriopsis* preparations among several tribes, including the Siona, Kofán and Inga. Among the Inga, several classes of *chiricaspi* are recognized. All of these are considered febrifuges and the term seems to be generic for plant medicines exhibiting this effect. Three kinds of *chiricaspi* are referable to *B. grandiflora: picudo* "beaked" *chiricaspi, salvaje* "wild" *chiricaspi,* and *chacruco* "of cultivated ground" *chiricaspi.* Of these, *picudo chiricaspi* is considered to be the strongest variety. To counteract fevers, a small stem 30 cm. long is used. The bark is scraped in cold water, let stand for two hours, then drunk. An Ingano *curaca* or healer at Mocoa told me that if three stems are used, one becomes intoxicated as with *yagé* and that it makes the whole body cold. *Chacruco* and *salvaje chiricaspi* do not differ morphologically from *picudo chiricaspi* but may represent chemical races of the plant. A fourth class of *chiricaspi* — *calentura* "fever" *chiricaspi* — is also known to the Inga. This shrub which grows in primary forest has been identified as *Stephanopodium peruvianum* P. & E. (Dichapetalaceae). The leaves are taken in cold water against fevers, as the vernacular names suggests. To date, no alkaloids have been encountered in this family (Raffauf, 1970).

Another tribe of the Putumayo, the Siona, also employs *Brunfelsia grandiflora* which they designate generically as *huha hai.* Two classes of *huha hai* are recognized. *Yai huha hai* is not cultivated but collected wild in the forest. Jean Langdon, an anthropologist working with the Siona, supplied the following account of *yai huha hai* along with voucher specimens collected by an informant:

> "The plant is used as a drink to give visions as well as to alleviate pain. To drink it, they grate the stem and drink the juice that comes out. The leaves can also be used if they are mashed up. Nothing else is added to the preparation, but it is often taken in conjunction with *yagé* or *yoko (Paullinia Yoco).* If taken with *yagé,* it is drunk before drinking *yagé.*"

The Siona describe the effect of *yai huha hai* as one of extreme coldness. It supposedly dulls all pains. The second

class of *huha hai* is cultivated and known as *bi'a huha hai*. It is cooked with *yagé*. Another Siona informant volunteered the following: "It makes you shiver when you drink *yagé*. It also makes your legs heavy and you feel like spines are sticking you. It is *fresco*, so it is good for curing sickness, as well as drinking with *yagé*." (Langdon, 1970).

The Kofán Indians of the Putumayo area are likewise familiar with the medicinal and intoxicating properties of *Brunfelsia*. Pinkley (1969, 1973) has stated that *Brunfelsia*, while not a common admixture to *Banisteriopsis*, among certain groups plays a role similar to that of *Brugmansia* in the magico-religious ceremonies of the shaman. *Brunfelsia grandiflora* is sometimes taken by the Kofán shaman in order to diagnose disease (Pinkley, 1973).

The Kofán, like other groups in the Putumayo, recognize three classes of *Brunfelsia* which are generically known as *tsontinba''k'o* in the Kofán language. Two of these are referable to *Brunfelsia grandiflora* and are distinguished primarily by where they grow. *Soci* (toucan) *tsontinba''k'o* is cultivated in houseyards around their settlements. *Chipiri* "small" *tsontinba''k'o* grows wild in the surrounding secondary forest.

4. **Brunfelsia chiricaspi** Plowman

The third kind of *Brunfelsia* known to the Kofán is called *covi* "tapir" *tsontinba''k'o*. This plant is considered to be the strongest of the *tsontinba''k'o* class and preferred for its potent drug effects. It belongs to a recently described species *Brunfelsia chiricaspi* Plowman, known only from the Colombian Putumayo and south to the Río Coca in Ecuador. This species occurs only in primary forests and is not cultivated.

While conducting ethnobotanical field work and general collecting in 1968, I visited the Kofán village of Santa Rosa on the Río Guamués, in order to study firsthand the use of *Brunfelsia* and other medicinal plants. The Kofán settlements in the Colombian Putumayo are being subjected to rapid changes as a result of large scale oil drilling operations in their territory. This made the Indians especially suspicious of strangers and highly protective of their medicinal plant lore.

I made contact with an old man in the village, who was considered knowledgeable about plants and medicines. After some time, I asked him about the use of *tsontinba''k'o* and *yagé*. He informed me that hardly anyone uses this medicine anymore because it is considered very dangerous. He disavowed any knowledge of *yagé* or of taking *tsontinba''k'o* for visions. Since it seemed no more information would be forthcoming, I asked the old Kofán to demonstrate the preparation of *covi tsontinba''k'o* for me and my companion, a Kamsá Indian from the Sibundoy Valley. He reluctantly agreed to do it and we decided to drink the drug at his small hut. In view of the complete lack of firsthand experiments with this *Brunfelsia*, I include the following account of the effects of *B. chiricaspi:*

> December 3, 1968: Village of Santa Rosa, Río Guamués, Comisaría del Putumayo, Colombia.
>
> "My companion, Pedro, and I arrived at Santa Rosa from San Antonio well before sunset on the night our Kofán *curaca* had chosen to prepare *covi tsontinba''k'o*. The *curaca* did not return to the village until nearly dark, carrying with him a handful of scraped bark which he had collected in the nearby forest. He said the plant is not common and he had had difficulty finding it. He extracted the juice of the greenish brown bark in a cup of cold water by wetting the bark and squeezing it repeatedly until the liquid became a murky light brown color. He then handed each of us half a cupful. The drink had a very bitter taste and pungent odor. We drank it quickly and sat down on the front porch of the *curaca*'s hut.
>
> "The effects of the drug appeared within about ten minutes. I first felt a tingling sensation in my lips, followed soon by the same sensation in my fingertips. This felt exactly like the feeling experienced when your leg "falls asleep", when the blood rushes back. Along with the tingling, I felt a pronounced vibrating in the affected parts.
>
> "The tingling soon spread into my mouth and upwards into my face; later into my hands and feet, tongue, elbows, and shoulders. After about an hour, the sensations were felt generally throughout my body, especially in my back, legs, face, lips and hands. There was a definite progression of the tingling from the base of my spine upwards towards the back of the neck, with ever-increasing intensity which centered at the base of my skull.
>
> "From the beginning I felt a strong urge to expectorate periodically and later realized that I was actually frothing at the mouth. In spite of the extraordinary sensations running through my body, I remained mentally lucid. I felt quite agitated from the

strong tremors produced by the drug. I was also seized by periodic waves of cold, as frequently reported by the natives.

"I next felt the tingling sensations and vibrations enter my head and scalp. Moving my head or hands increased the intensity of the sensations. The vibrations felt electric, penetrating my chest and back. Even then my thinking remained undisturbed though somewhat detached.

"After another hour, I began feeling sharp stomach cramps and occasional spasms of nausea. I wanted to vomit but could not. We had fasted since the previous day according to the *curaca*'s instructions. The tingling remained very intense in my hands and feet and my head began to ache. A bitter taste developed in my mouth and I felt vaguely cold.

"Sometime later — I was incapable of telling time at this point — I began to get used to the tingling sensations, which I found disquiting at first. I could not tell if I was becoming stronger or weaker. I became very dizzy with vertigo, which intensified precipitously. Everything started spinning to the right yet never seemed to move. My mind kept adjusting to the spin to set me right agin. There was a complete loss of muscular coordination at this point, and I could no longer walk or even stand up. I lay either prone or sat on the floor with my back against the wall for the rest of the night. The pains in my stomach became more acute. I continued to be nauseous and vertiginous and felt extremely uncomfortable.

"During the course of the evening, the *curaca* went to bed. We did not see him for the rest of the night except for a brief appearance upon our departure. Since we were feeling increasingly out of sorts in this strange place, we decided to return to the nearby village of San Antonio where we were staying in an abandoned jail cell. It was very difficult to move or stand up, but eventually we mustered enough strength to start for home. This took at least an hour with Pedro and I supporting each other, frequently stumbling and crawling along the dark trail through the forest.

"When we arrived in San Antonio, we climbed into our hammocks to rest. I lay awake for a long time, still feeling the drug in my body, particularly the tingling. The stomach cramps and vertigo began to subside, and eventually I fell asleep, completely exhausted both mentally and physically. The next day, I felt extremely weak and nearly unable to move without great discomfort. I became very dizzy if I tried to stand up or walk. I could not eat anything and remained in my hammock. Only after two full days did I begin to recover and move around without becoming dizzy."

My companion later noted the following effects which he experienced with the drug: "swollen lips and heavy tongue, crazy in the head, cold sweat, stomach ache, nausea and weak

vomiting, urtication, inability to walk or move, and vertigo''. He also felt ''the world was spinning around me like a great blue wheel. I felt that I was going to die''.

The effects described above correspond in some respects to accounts in the literature of the effects of other species of *Brunfelsia*, especially *B. grandiflora*. The notable tingling sensation, or parasthesia, apparently results from a peripheral vasal constriction of the capillaries. A well known drug with this effect is nicotine, and the same reaction is frequently reported in persons who have smoked their first cigarette. The increased stimulation of the salivary and sweat glands is highly reminiscent of the effects of *manacá* root discussed earlier.

In view of the toxic effects which we experienced from *Brunfelsia chiricaspi*, it seems unlikely that anyone would knowingly ingest the plant in this dose except possibly in a desperate medical situation. More likely, smaller amounts are used which become further diluted when mixed with extracts of other plants such as *yagé*.

We may also ask the question: why is *Brunfelsia* used in preparing *yagé*? Certainly its medicinal properties are important in this respect, for the use of *yagé* is grounded in its medicinal applications. *Yagé* itself is a strong purgative and may have vermicidal and bactericidal properties as well. Both these plants would then serve as strong medicinal agents irrespective of their psychological or hallucinogenic effects. These are, however, of equal import to the shaman.

It is well established that *Banisteriopsis caapi*, besides being a purgative, is a strong visual and perhaps auditory hallucinogen. Sundry other plants may be added to preparations of *B. caapi* to vary and intensify the experience. Most notable among these are the leaves of *Banisteriopsis Rusbyana* and *Psychotria viridis* (Pinkley, 1969; Rivier & Lindgren, 1972). Both of these plants contain the potent hallucinogen N,N-dimethyltryptamine as their main active constituent, the effects of which differ somewhat from the harmine derivatives found in *B. Caapi* (Agurell *et al.*, 1968; Der Marderosian *et al.*, 1968, 1970). Since N,N-dimethyltryptamine also produces strong visual effects, we can readily see why the shaman would include these plants in his brew.

Since *Brunfelsia* species appear to produce no striking visual hallucinations, we must look further for the rationale for including these plants in *yagé* preparations. Of the diverse physical effects of *Brunfelsia*, I would single out the tingling sensations as the most pronounced and bizarre and those which might best potentiate the hallucinatory *yagé* experience. By using smaller doses than I ingested, the Indians would be able to produce striking tactile hallucinations without the toxic side effects. The combination of these drugs may produce, perhaps synergistically, unique and other-worldy experiences and sensations. Because one often feels decreased sensitivity and numbness in the body with *yagé* alone, the addition of *Brunfelsia* to the drink may also serve to create a greater physical awareness during the ceremony.

Although each of these potent psychoactive plants is employed individually for their specific effects, their use in combination was learned and perfected by native shamans through centuries of experimentation. Only these skilled practitioners fully understand the delicate questions of dosage and correct admixture to achieve specific physical and psychic effects.

5. **Miscellaneous species**

Other species of *Brunfelsia* are known to contain active constituents such as alkaloids or to be used medicinally. Some of these such as *B. brasiliensis* and *B. pauciflora* have already been mentioned. The fruits of *B. australis*, a species of Argentina and Paraguay, are added to food as a condiment by the Guaraní Indians. Known as *azucena* or *jazmín del monte*, *B. australis* is noted on herbarium labels as being medicinal or poisonous. The root is used as *B. uniflora* as a remedy for syphilis (*Woolston 571*), and the foliage is reputed to be harmful to horses (*Pederson 10210*). *B. guianensis* Benth., which grows in Amazonian Brazil as well as the Guianas, is also used like *B. uniflora* — as an antisyphilitic, antirheumatic, depurative and poison in high doses (Le Cointe, 1947).

Brunfelsia species in the Caribbean are also known to be employed medicinally, though not nearly so commonly as in South America. *Brunfelsia americana* L., the most widespread

species in the Antilles, bears an astringent fruit which has been used as a tonic to cure chronic diarrhea and stomach problems (Descourtilz, 1833; Duss, 1897; Manfred, 1947). In the island of Dominica, it is called *empoisonneur* and is employed as a poison by the Island Caribs (Hodge & Taylor, 1957). Traces of cyanide have been found in the leaves and flowers as well as in the bark of the stem and root (Quisumbing, 1951). Chlorogenic acid is reported from the leaves (Politis, 1948).

Scott and colleagues (1957) tested the leaf and stem of *B. americana* for alkaloids. They found two products: one a crystalline substance which melted at 125-130°; the other consisted of long needles which melted at 218-220°. They obtained positive alkaloid tests for both products but did no further work on the plant.

Brunfelsia nitida Benth., a widely cultivated Cuban species, is used for herbal baths (Roig & Mesa, 1945). The fruits of this species were found to be strongly alkaloid-positive (Alemán Frías, 1972). Unnamed alkaloids have also been detected in the stems of *B. undulata* Sw., a Jamaican species (Willaman & Schubert, 1961); Willamam & Li, 1970), and in the leaves and fruits of *B. Shaferi* Britt. & Wils., a Cuban endemic (Alemán Frías, 1972).

In conclusion, the need for modern detailed studies on the pharmacology and chemistry of *Brunfelsia* cannot be overemphasized. I have outlined here what is known about the folk uses and pharmacology of the species known to be active. However, the entire genus merits intensive investigation to isolate and identify its alkaloidal and other constituents, which have eluded chemists for so long. The possible value of certain species in the treatment of arthritis and rheumatism is especially important and worthy of detailed study using modern methods.

Acknowledgments

Research reported in this paper was supported in part by the National Institutes of Health Training Grant (T T01 GM 00036-13) and by the National Science Foundation Evolutionary Biology Training Grant (GB 7346, Reed Rollins, Principal

Investigator, Harvard University). I would also like to thank the following persons who kindly read the manuscript and offered useful comments: B. Holmstedt, J.E. Lindgren, R.E. Schultes, and P.G. Williams. I am most grateful to H.V. Pinkley and J. Langdon for sharing with me their ethnobotanical observations on *Brunfelsia* and to L.T. Bates for making the line drawing of *B. mire*. I would also like to thank the curators of the following herbaria for the loan of specimens pertinent to this study: BM, COL, ECON, F, G, GH, K, MO, NY, P, PH, PR, S, UC, US, W (abbreviations after P.K. Holmgren & W. Keuken, 1974. Index Herbariorum, Part I, ed. 6.; Utrecht).

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PLATE 63

Folia habet citriis haud diſſimilia, paulo tamen longiora & molliora, & qualitate refrigerandi & abſtergendi prædita.

Præter alias dotes, quibus excellunt, vulneribus atque ulceribus opitulantur, parteſque vitiatas reparant. Cujus rei Chirurgi noſtri non ignari, ea in quotidianum uſum colligunt.

Raro videas viatores iter ſuſcipere, niſi probe hoc remedio inſtructos.

Succus oleoſus denique è ſiliquis expreſſus, ad maturanda apoſtemata reſervatur, & applicatur cum proſpero ſucceſſu.

CAP. XLIII.

De Manaca frutice, ejuſque facultatibus.

LOcis umbroſis, maxime circa *Aldeam Tapicirica* luxuriat Frutex arboreſcens *Manaca*, cortice gryſeo, ligno duro quidem, ſed fragili, ex albo cineritio, foliis acuminatis.

Flores fert exiguos, quorum alter cœruleo, alter vero (quod ut rarum, ita maxime jucundum) lacteo nitore niteſcit: Menſe Januario vegetus & valde ſpecioſe floreſcens conſpicitur, atque integras ſilvas inſigni fragrantia Narciſſi æmula implet.

Flori ſuccedit fructus baccæ Juniperi ſimilis, ſed inutilis.

Radicem habet magnam, ſolidam & albicantem, cujus medulloſa ſubſtantia in pulverem redacta, magna in Medicina poliicetur & præſtat.

Incolæ pæne omnes, tam Luſitani quam Braſiliani, licet magni æſtiment, tamen ob indomitas operationes hactenus in uſum admittere vix auſi fuerunt. Quippe periculo non vacat hoc genus medicamenti, quod nimis violenter corpus ſuperne & interne moveat. Quamobrem tantum hominibus robuſtiſſimis exhiberi ſolet, idque additis correctoriis, tum & juſta obſervata doſi, quæ Scammonei potius inferior quam ſuperior eſſe debet: ad illud enim validum medicamentum proxime accedit hæc radix; verum non ita inſipida eſt, amarore enim & acore non plane deſtituitur.

Plate 63. First Description and Illustration of *Manacá* Root (*Brunfelsia uniflora*) in Piso's *De Medicina Brasiliensi* (1648).

PLATE 64

Plate 64. Illustration of *Brunfelsia uniflora* in von Martius' *Flora Brasiliensis*, vol. 8 (1): plate 43. 1862.

PLATE 65

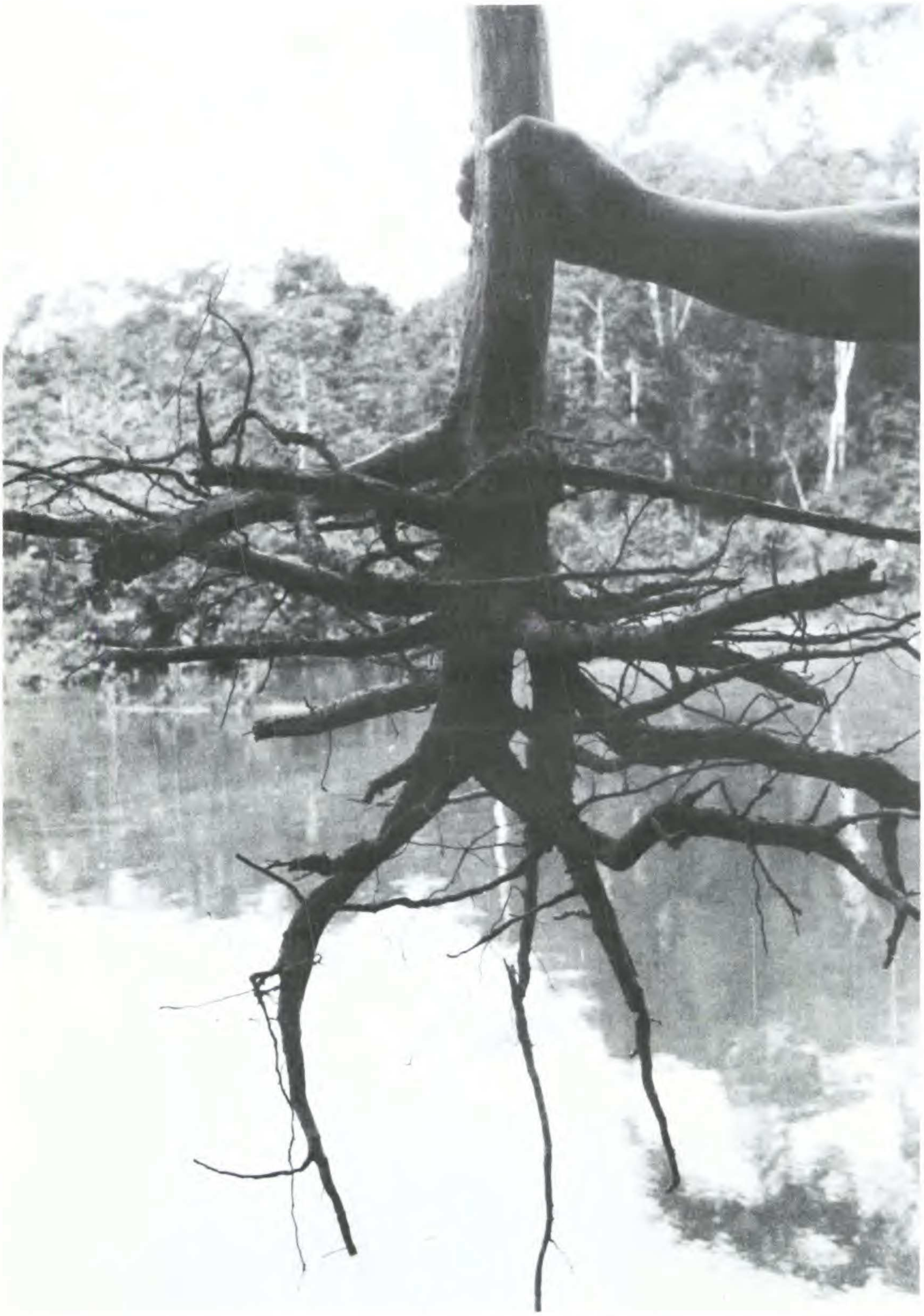

Plate 65. Medicinal Parts (Roots and Stem) of *chiric sanango* (*Brunfelsia grandiflora* subsp. *Schultesii*) collected on the Amazon River near Puerto Nariño, Amazonas, Colombia (*Plowman et al.* 2407).

PLATE 66

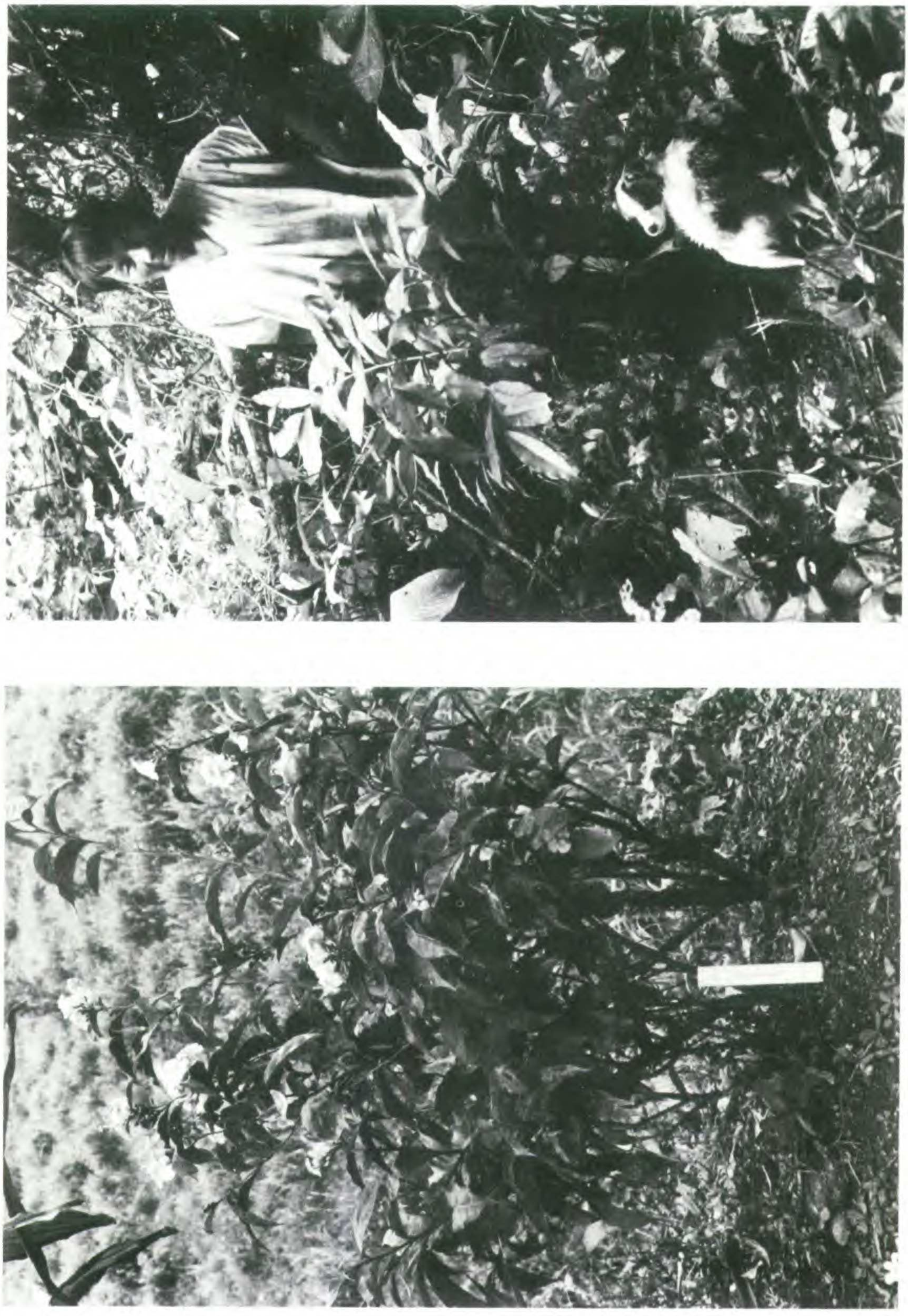

Plate 66. *Brunfelsia grandiflora* D. Don. Colombia: Comisaría del Putumayo. Left: Shrub cultivated in Indian houseyard near Mocoa. Right: Wild plant found growing in secondary forest near Puerto Limón.

PLATE 67

Plate 67. *Brunfelsia Mire* Monachino. 1. Habit. 2. Flowering Branch. 3. Fruit cluster.

PLATE 68

Plate 68. *Brunfelsia americana* L. From Burman's Edition of Plumier's *Plantarum Americanarum* (1756).